



This inspiring series on 'Scientists of the World' has been specially planned for children. Young readers will find that science is fascinating and that it has made the world a far better place to live in.

A special feature of the series is that it highlights each scientist's childhood. Young readers will see quite vividly that the great scientists had once been children like themselves and that if their natural curiosity as children can be combined with perseverance, they may also be able to achieve what these people did.

Little Homi was always fond of the laboratory. It was to lead him to a great interest in nuclear energy. What were his contributions to science?

*Amrita Patel worked with Indian Metals and Ferro Alloys. Her love of science led her to an M.Sc. degree in Physics.*

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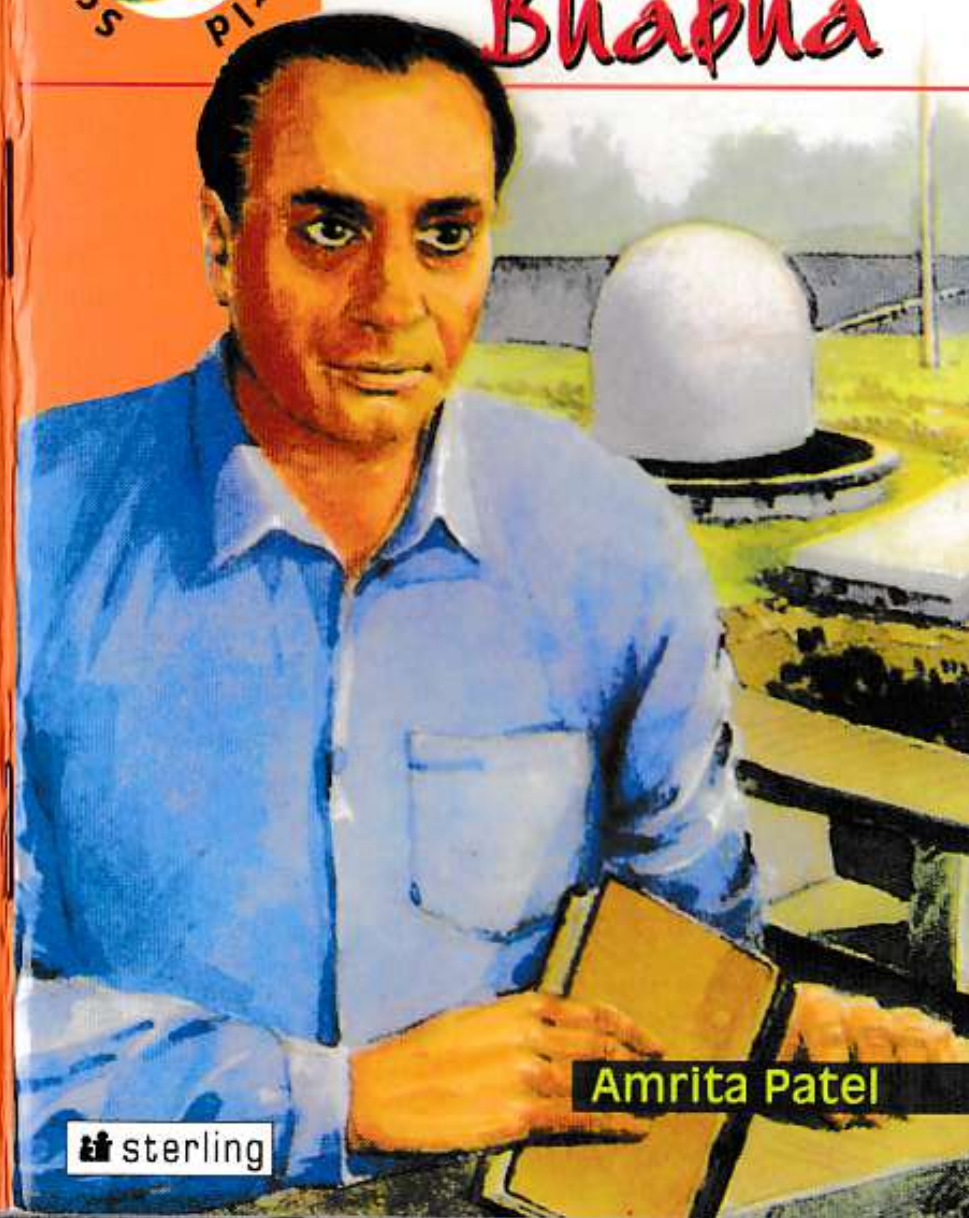
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Scientists of the World

Homi Bhabha



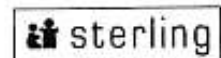
Amrita Patel

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Scientists of the World

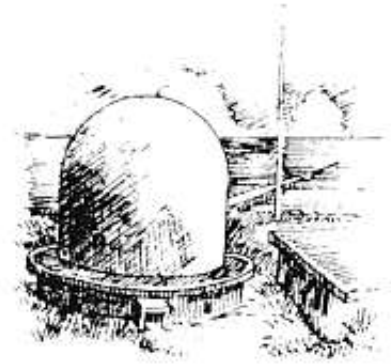
*Homi Bhabha*

**Amrita Patel**



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## *Childhood*

J.H. Bhabha was a famous lawyer in Bombay. He was a very cultured man. He had studied at England. Besides being a lawyer, he was also a consultant to the Tata Company. The Tata Company is a big industrial company.

Meherbai was Mr. Bhabha's wife. She was a cool-minded, intelligent and educated lady. It was to this couple that Homi J. Bhabha was born on October 30, 1909. The Bhabhas were thrilled when their first-born was a son. Homi's mother, Meherbai, brought him up with great love and care.



The Bhabhas belonged to the Parsi community. The Parsis originally belonged to Persia or Iran, and had settled down in India many years ago. They are a very educated, cultured, peaceful and hard-working people.

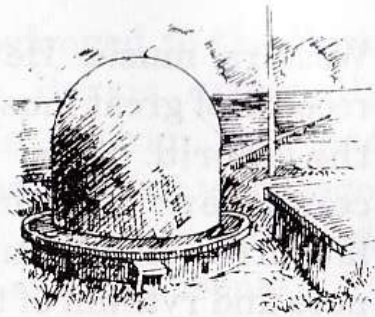
Homi loved music. Even as a baby, it appealed to him. One day, little Homi started crying. His mother tried her best to calm him. She put him on her lap and gently rocked him so that he would stop crying. But Homi would not stop. Just then, someone in the next room happened to play some music. Homi's crying immediately stopped. He looked around the room and gave a toothless smile to his mother. Meherbai was amazed. She thought to herself, 'Next time Homi cries, I just have to put on some music.' Sure enough, that did work.

This childhood interest in music remained with Homi all along. As he grew up, he learnt Indian as well as

Western music. He loved listening to records of great musicians from all over the world. The great European composer, Beethoven, was his favourite. Homi could remember every note and rhythm of the music. He could repeat the tunes without any effort. Very often, the whole family used to sit together to hear Homi play.

When Homi was a small baby, he slept very little. His parents were worried about this. Meherbai said to her husband, "We must take Homi to a doctor." The doctor checked the baby thoroughly, and said that there was nothing wrong with the child. Finally, they took him to a European doctor who said that the reason the child slept less was because of his excessive mental activity, and that this was a sign of intelligence. Even as a baby, Homi showed signs of being a genius.

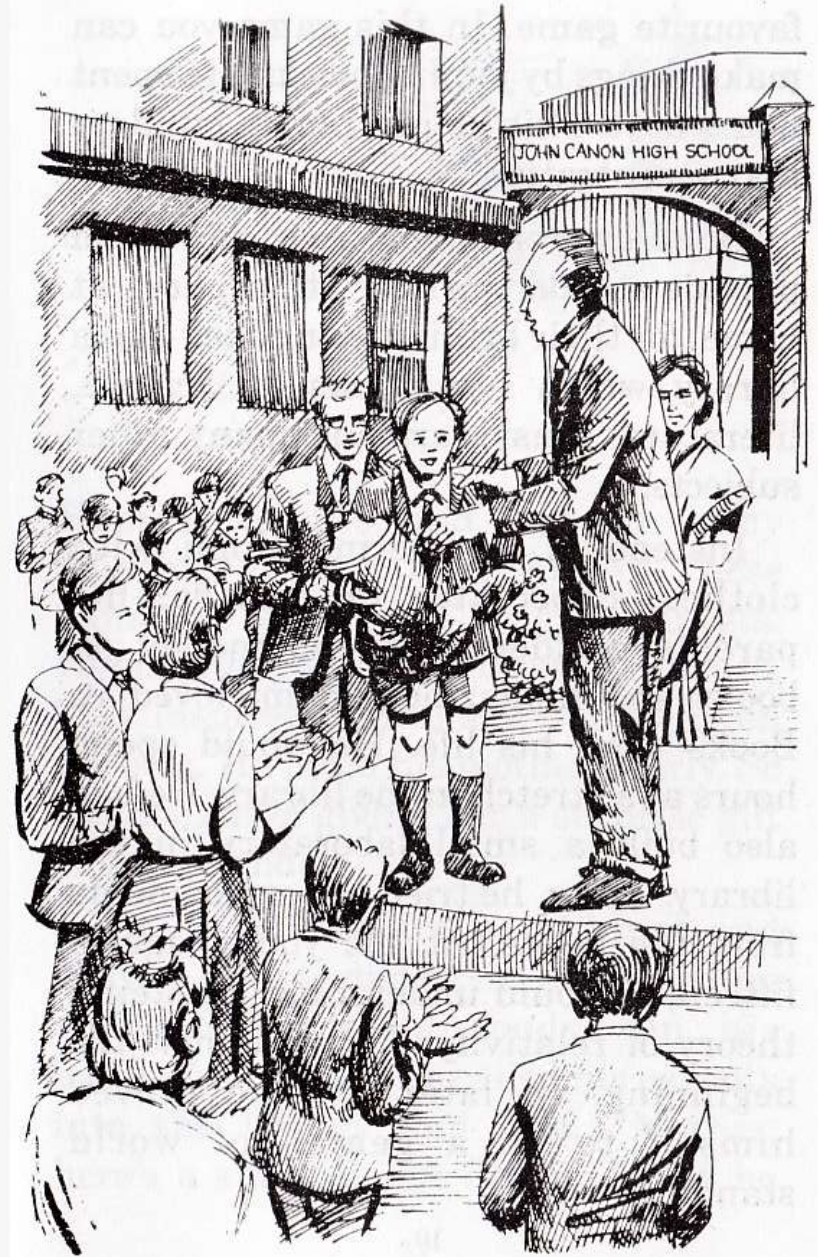




### *A mind of brilliance*

Homi's parents were educated people. They wanted Homi to have the best education. He did his schooling at the Cathedral and John Canon High School at Bombay. He was a very bright student. He had such a sharp memory that he could remember each and every thing taught by his teachers. This helped him to do very well in examinations. He won so many prizes that the whole of Bombay came to know about him. He was, no doubt, the most brilliant student in Bombay.

Homi was not very interested in games. However, 'Meccano' was his

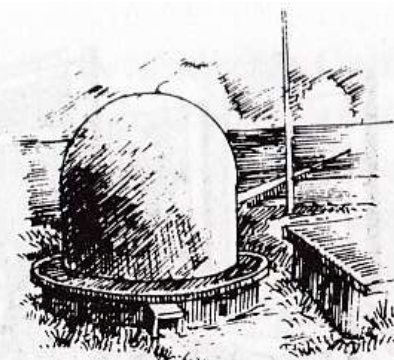




favourite game. In this game you can make things by joining blocks. He spent hours at it. This helped him to build up his concentration.

Homi's parents were rich, and could provide a good working atmosphere at home, for their brilliant son. They had a library which had books on science, literature, music, art and many other subjects.

Instead of pampering Homi with clothes, chocolates or movies, his parents decided to spend money on books and magazines. Homi loved it. Books were his life. He would spend hours at a stretch in the library. He had also built a small laboratory in the library. Often, he tried out experiments from the books. At the young age of fifteen, he could understand Einstein's theory of relativity. This was just the beginning. In later life, he proved himself to be a genius of world standing.



### *Homi starts painting*

Homi's parents had put up many paintings in their home library. These paintings were done by great artists. Homi often gazed at them for hours. This inspired him to start painting on his own. He loved his mother dearly. So he thought of giving her a surprise gift on her birthday.

He bought colours, paint brush and canvas, and started on his first painting without telling anybody. On his mother's birthday, he called his parents into the library and said, "Mother, here's a surprise gift for you." And he



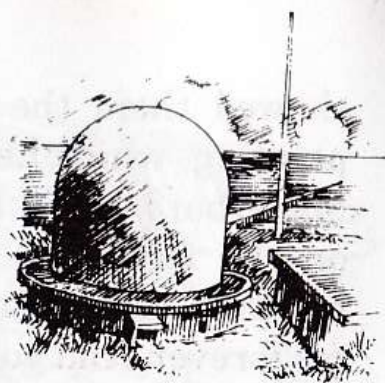


showed them the 'Cow and the Calf' painting, which he had just completed. Meherbai hugged him, gave him a kiss on the forehead, and said, "Son, the painting is beautiful. I'll keep it with me forever. And you must never give up painting."

As Homi grew older, his tender feelings turned to nature. The plants and the flowers excited him and he drew scenes of nature. Later, he also took painting lessons from a renowned artist in Bombay. At the age of fifteen, he passed the Senior Cambridge examination. After that he joined Elphinston College and the Royal Institute of Science.

Homi was ambitious from childhood. He never wasted any time. He spent his free time either painting or playing music, or experimenting in the laboratory.





### *Homi studies at England*

While studying at the *Royal Institute of Science*, Homi grew deeply fond of physics and mathematics. After college, he wanted to study these subjects in detail. But his father wanted to train him as an engineer.

“Son, you must be an engineer, not a scientist. This will help you to get a good job in the Tata Company,” said his father to him, one day.

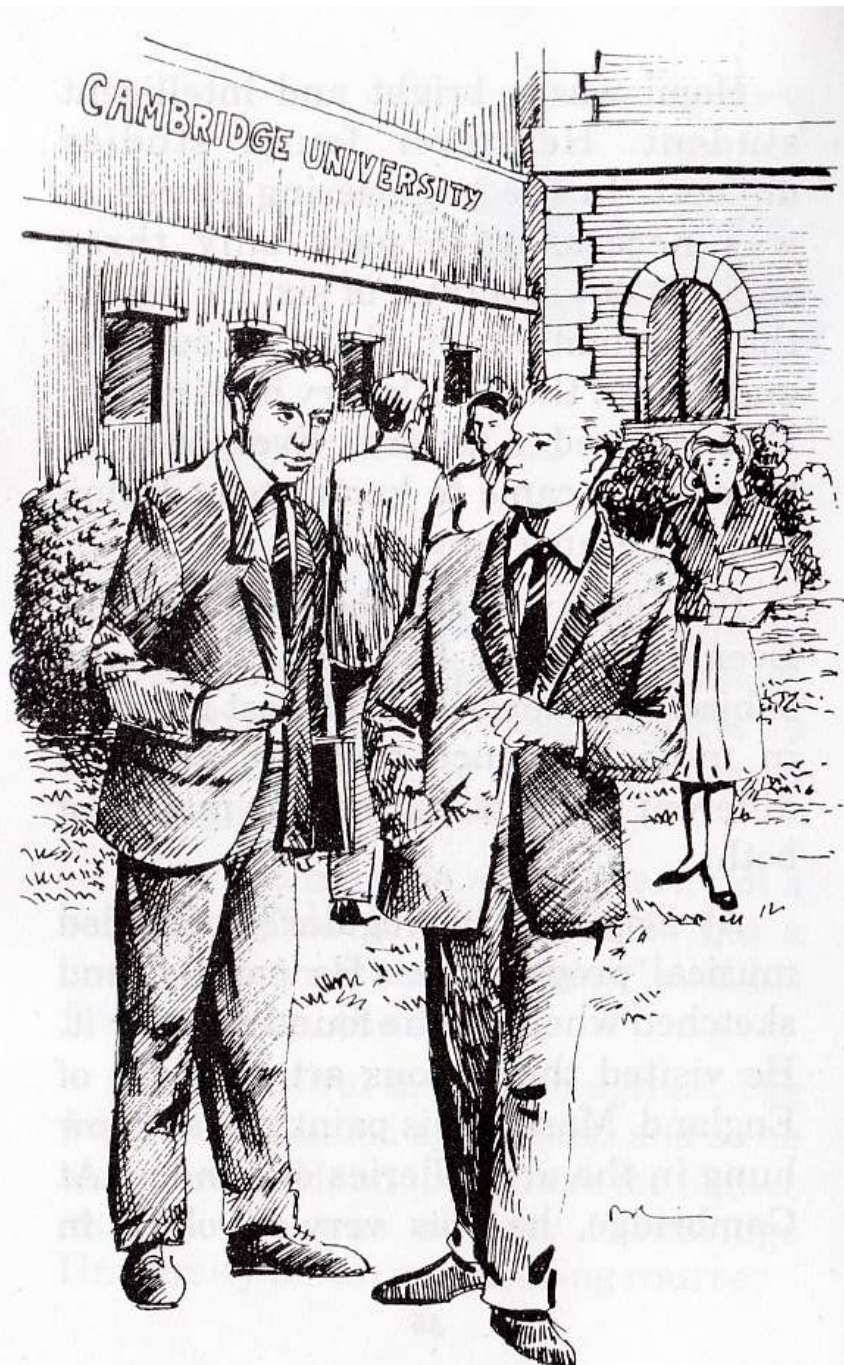
Like a dutiful son, Homi agreed. His father had studied at England and so he also wanted Homi to go there for higher studies. He was sent to Cambridge University for an engineering course.

Homi was a bright and intelligent student. He never found studies difficult. In the engineering course, it was necessary to pass only three subjects out of a total of six. He sat for the examinations of all the six subjects and passed them with very high marks. This created a record. Everybody at Cambridge came to know about Homi, and he became famous.

But Homi was not a bookish student. Even though he had to study many subjects, he never lost interest in art or in music. Science and art are two different subjects, but he was master of both.

At England, he regularly attended musical programmes. He painted and sketched whenever he found time for it. He visited the famous art galleries of England. Many of his paintings are now hung in the art galleries of London. At Cambridge, he was very involved in





college activities. He, in fact, conducted many orchestras with his friends.

So children, you must not spend all your time reading school books. You should try to have a hobby, whether it is singing or painting or hiking or stamp-collecting. Remember, "All work and no play makes Jack a dull boy."

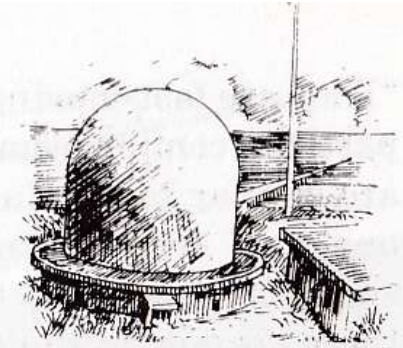
At Cambridge, while Homi was studying for his engineering degree, his interest in science was fully satisfied. He could read the latest scientific magazines and books. He was devoted to studies and was determined to excel in it.

In 1930, he obtained the Mechanical Engineering degree. After this, he was awarded a scholarship to study mathematics, in Europe, for two years. He was overjoyed. At last, his dream to study mathematics was coming true. He looked forward to working with eminent physicists like Pauli and Fermi.



In Europe, besides studying, Homi visited the museums and the art galleries, and attended musical programmes. He lived in Europe for many years where he picked up progressive ideas like the equality of men and women, and the importance of education.

As the years rolled by, he delved deeper into science and maths. He received many important and prestigious prizes and scholarships. In 1934, he was given a Ph.D. degree in science.



## *Researcher and scientist*

After Homi Bhabha finished his studies and got a doctorate in science, he became a professor of physics at the University of Cambridge.

He did wonders as a teacher. His students loved his teaching. He taught the most difficult problem in a very methodical, systematic and simple way. He had a very good understanding of science and taught it interestingly.

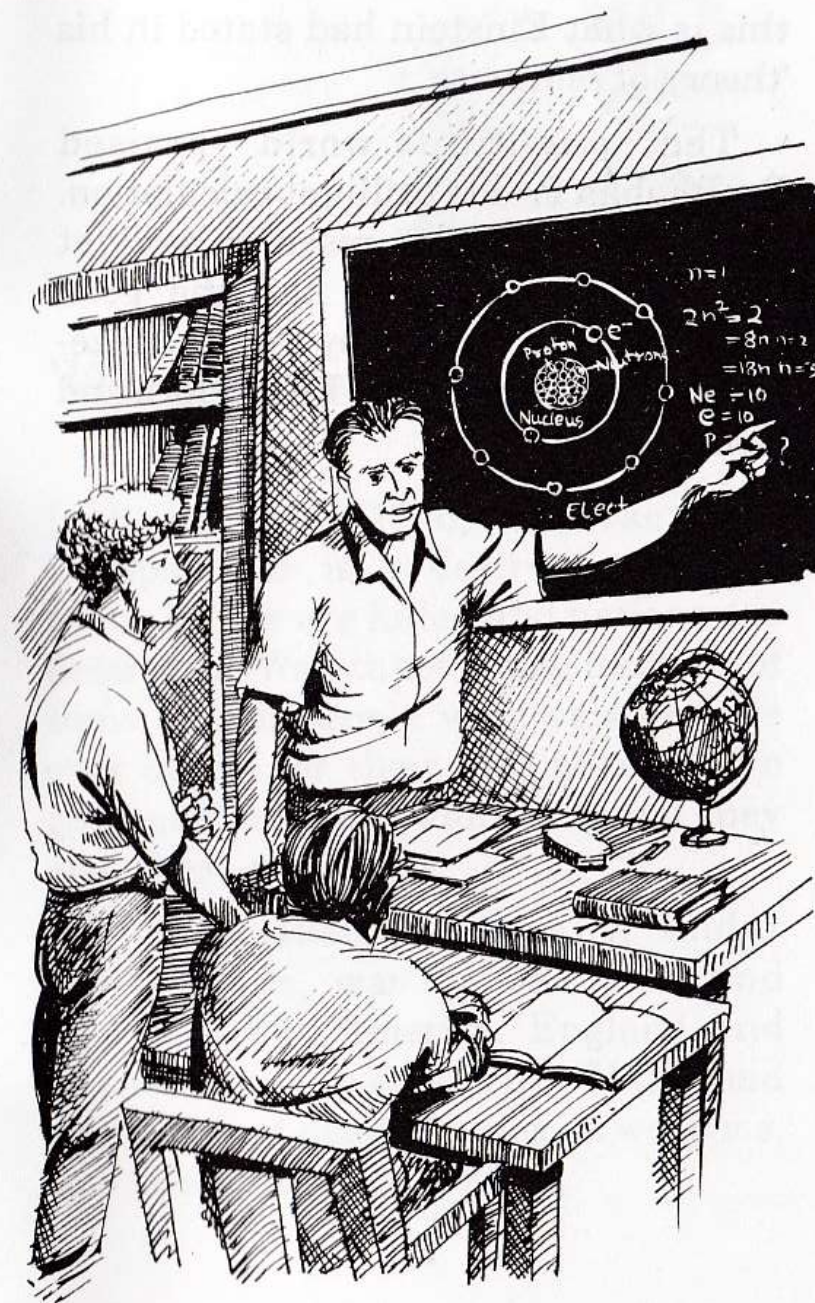
Meanwhile, he did research on 'cosmic rays'.

"Let me explain what 'cosmic rays' are," he said to his students, one day.



“They are fast-moving, extremely small particles coming from outer space. They are similar to the dust particles which one can see floating in a beam of sunlight in a dark room. Now, when these ‘cosmic rays’ or particles enter the earth’s atmosphere, they hit the air and produce showers of electrons. Electrons are charged particles.”

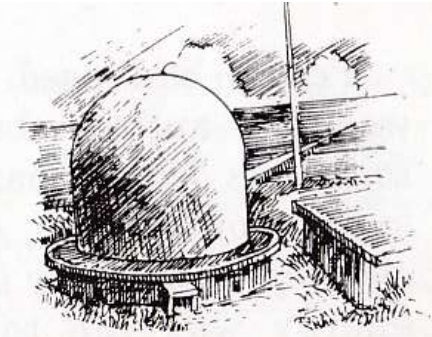
At that time, these ‘cosmic rays’ were just discovered, and nobody knew much about it. Scientists all over the world were keen to know about them. In 1937, Homi Bhabha and a German physicist solved the mystery surrounding these rays, and became world-famous. In fact, Dr. Bhabha went a step further. He could see that the ‘cosmic rays’ had a new particle which the scientists did not know about earlier. Homi called these new particles ‘mesons’. He used Einstein’s theory of relativity to prove that as the speed of ‘mesons’ increases, they live longer. And





this is what Einstein had stated in his 'theory of relativity':

The scientific world praised Dr. Bhabha for his brilliant calculation. Of course, during his research work at England, Dr. Bhabha had the good fortune to be guided by Nobel Prize-winning physicists, like Rutherford and Neil Bohr.



## *War breaks out in Europe*

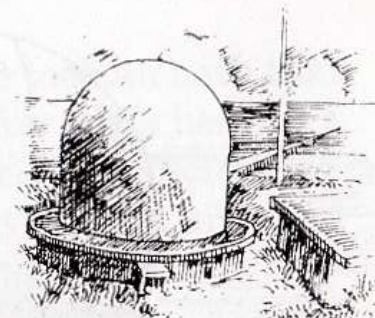
In the summer of 1940, war broke out in Europe. War is a destructive event. Many people are killed and nations are destroyed. War takes place because of some selfish people who want to rule over others for their own benefit. The good people do not want this, and they stop these mean acts.

In the 1940s, Germany, under Hitler's rule, was on one side, and countries like America, England and France were the opponents. Hitler had spent a great deal of money on weapons, and the world was terrified.



People had used science to make weapons and bombs. By this time, scientists knew that the atom is a source of energy. An atom is the smallest part of any substance. Atomic energy was the topic of research everywhere, and every country wanted to make atom bombs.

Dr. Bhabha had created a name for himself in the scientific community for his work in atomic physics. Countries like England and America wanted to use his knowledge and experience. The government of these countries wanted him to do research for them. It was indeed an honour for him. But he was a patriot who wanted to serve India. So he refused.

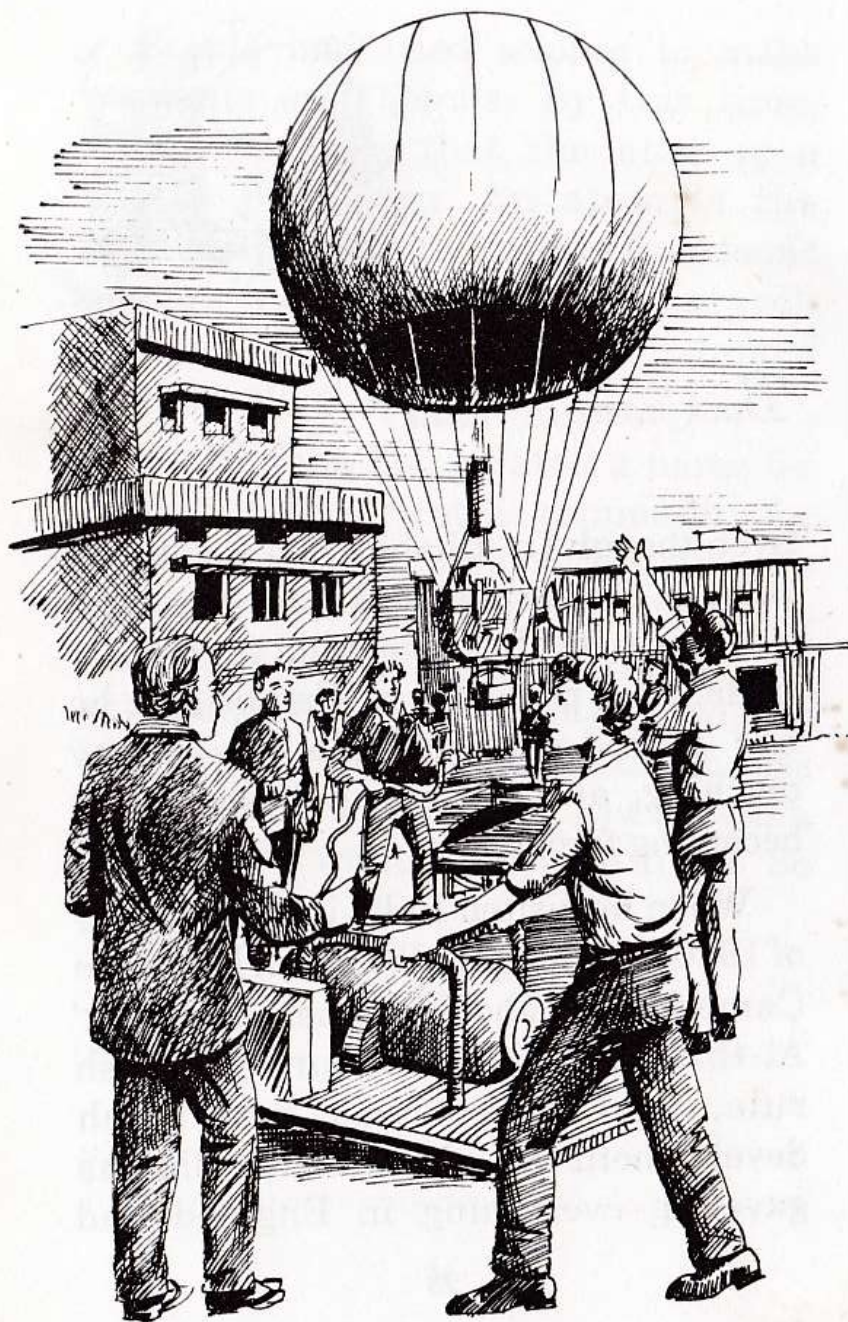


### *Back home in India*

Even though Dr. Bhabha had spent long years at Cambridge and other countries of Europe, he always wanted to work for India. As a professor at Cambridge, he had a well-paid job. He was happy teaching, and his research work was becoming famous.

When he visited India in the summer of 1940, he thought, 'What am I doing in Cambridge? I should be here in India.' At that time, India was under British rule, and there was not much development in science. Dr. Bhabha gave up everything in England and





returned to India. He took an oath that he would rest only after India became a world leader in science. Scientific development in India was his aim, and he dedicated his life to this cause.

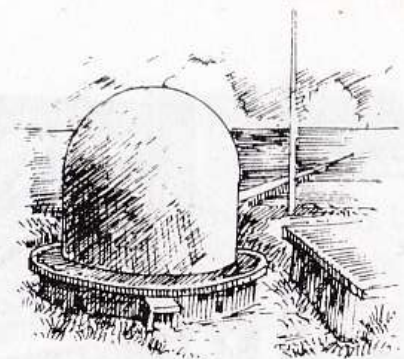
On returning to India in 1940, he joined the Indian Institute of Science at Bangalore. This is one of the leading research institutes of India. Dr. C.V. Raman was its director then. Dr. Raman had won the Nobel Prize for physics in 1930. Here Dr. Bhabha did more work on 'cosmic rays'. Dr. Raman often gave valuable advice and suggestions to him on his research work.

At Bangalore, Dr. Bhabha sent huge plastic balloons carrying instruments, high up into the air. He was hopeful that more could be learnt about 'cosmic rays' by such experiments.

In 1941, he was elected Fellow of the 'Royal Society of London'. It was a great



honour for him. The 'Royal Society' gave him money to carry out experiments and do research on new subjects of physics. Homi did not waste the money, and used it to do experiments and research work.

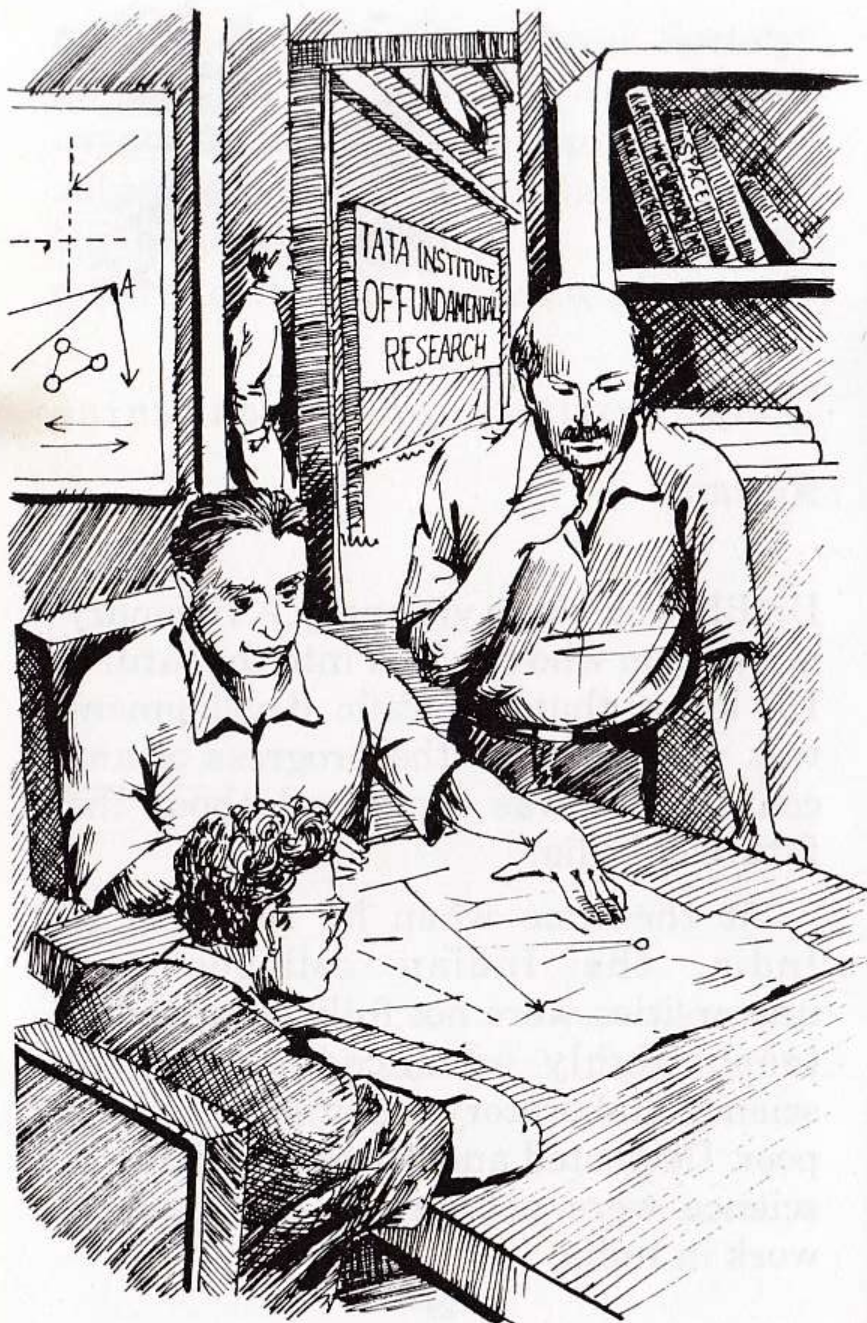


## *Tata Institute of Fundamental Research*

Dr. Bhabha was a visionary. A visionary is a person who can look into the future. He knew that scientific development was necessary for the progress of any country. He was concerned about the future of India.

At the time when he returned to India, the Indian colleges and universities were not fully equipped to teach highly advanced aspects of science. Laboratory facilities were also poor. Dedicated and serious students of science were not able to do research work in India.





Viewing all this, Dr. Bhabha thought to himself, 'To remove this shortcoming, a research institute, equipped with the latest equipments, is highly necessary. Such an institute will be of great help to the upcoming scientists. I must do something about it.'

When he discussed this proposal with the other scientists, they all supported the idea.

So in March 1944, Dr. Bhabha wrote a letter to the Tata Trustees. In this letter he wrote about the subjects on which research and advanced teaching should be done. He suggested that a research institute be set up soon, to help the scientists in India.

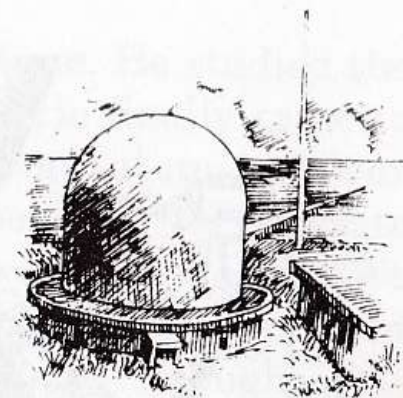
As a result of the war in Europe, scientists all over the world were experimenting with the atom, to make bombs. But Dr. Bhabha was a different man. He knew that making an atom bomb was an achievement, but to use



the atom for the welfare of mankind was a bigger achievement.

In the letter to the Tatas, he wrote: We must be able to produce nuclear scientists ourselves instead of depending on foreign help. Indian scientists should be able to build nuclear plants for power production. Before anybody else could, he suggested that nuclear power plants be built for the benefit of human beings.

The Tatas liked his suggestion. He was called to Bombay for the final discussions. And in 1945, the Tata Institute of Fundamental Research was set up and Dr. Bhabha was made its first director. Setting up of the Tata Institute was a milestone in India's progress in the sophisticated field of nuclear science. Scientists all over India hailed Dr. Bhabha's efforts.



## *Uses of the atom*

Dr. Bhabha can be regarded as the father of nuclear science in India. His views on atomic power were very clear. He wanted atomic energy to be used only for peaceful purposes. India was a country with many poor people. They did not have enough drinking water, electricity and medicine. Nuclear energy could be used to improve their lifestyle.

Dr. Homi Bhabha worked hard to achieve his goal. He collected data and figures. He found out that India did not have enough coal and oil to produce





energy for a long time. He studied the situation in detail. He finally came to the conclusion that atomic power stations had to be built to generate power. He told Jawaharlal Nehru, "We have no alternative. We must build atomic power stations. Though it is expensive, it is essential."

The electricity that we use in our homes is produced in power stations. Traditional power stations use coal and oil and are known as thermal power stations. There are some which use water, and are called hydroelectric power stations.

But in atomic power stations, certain materials like uranium and plutonium are mixed with other material, and energy is produced according to Einstein's famous equation  $E = MC^2$ . The energy produced from such atomic power stations is a million times greater than that obtained from burning coal. For example, one



kilogram of uranium will produce energy equal to that obtained by burning 3 million tonnes of coal. And one tonne is equal to 1,000 kilograms.

Nehru welcomed the suggestions made by Dr. Bhabha. And when the 'Atomic Energy Commission' was formed in 1948, Dr. Bhabha was made its Chairman. Our parliament also passed a law to encourage research in atomic energy, for peaceful uses.

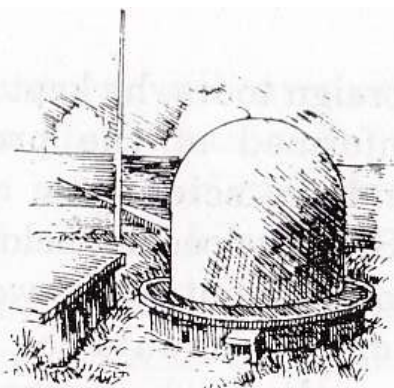
Dr. Bhabha was a true Indian. He wanted India to be a peaceful and scientifically developed country. He never hesitated in expressing his views on what was beneficial to India and other such poor countries.

For his knowledge and views on atomic power, he was made the President of the 'Atom for Peace' conference held at Geneva. He got many invitations to lecture at different universities abroad. During all such

foreign tours, he kept foreign scientists informed of the progress made by Indian scientists. He told them, "Science does not belong to a particular country, but to the world. The doors of science should be kept open for everybody who works for the welfare of humanity." He invited foreign scientists to India. This way, the scientists of India could benefit from the ideas of foreign scientists. They could discuss the latest views on the subject. He never missed an opportunity to encourage Indian scientists. All this gave them immense confidence.

In 1957, the Government of India awarded him the Padma Bhushan. Many universities in India, as well as those abroad, bestowed on him the degree of 'Doctor of Science'.

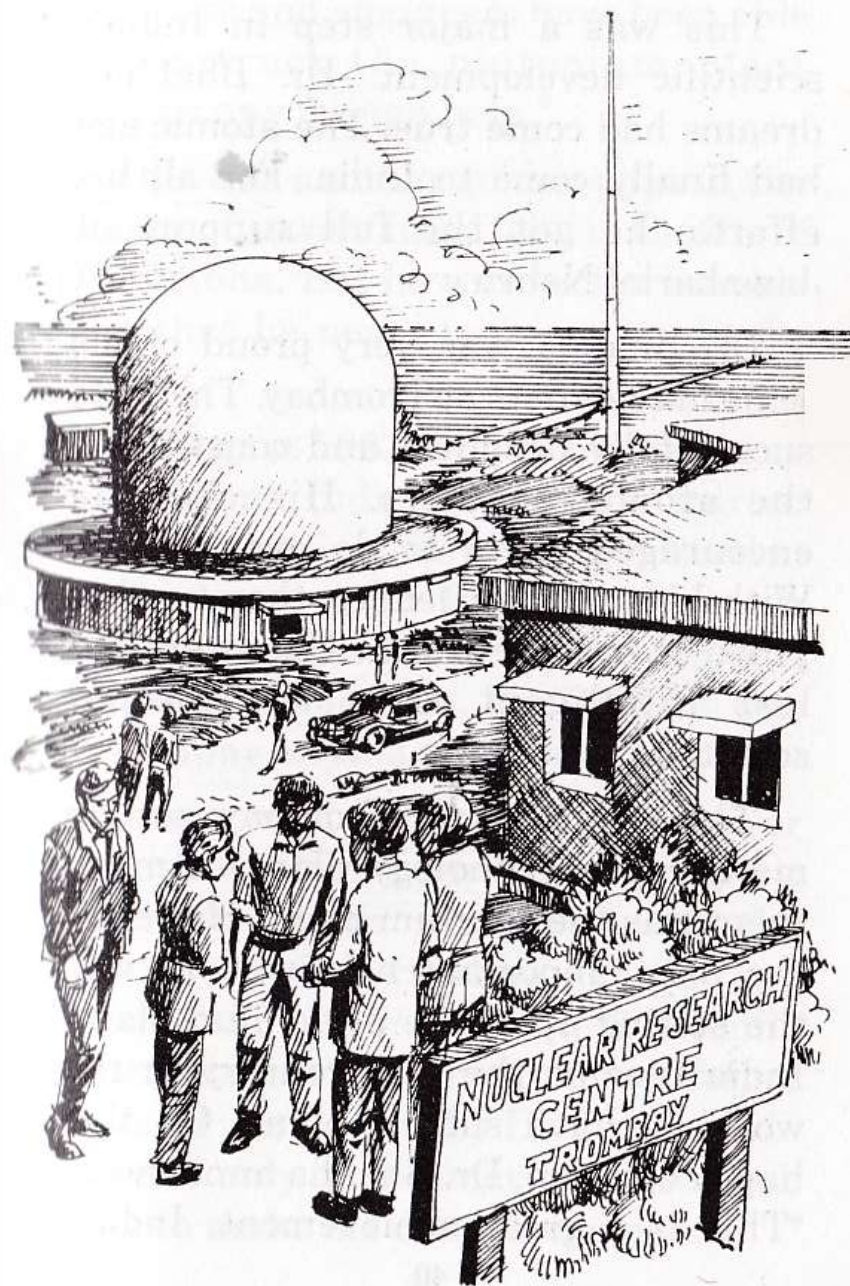




## *The atomic age in India*

The first atomic research reactor in Asia was set up in India, in 1955, at Trombay, near Bombay. This was possible due to Dr. Bhabha's efforts. About 200 scientists worked on the project.

Atomic energy is produced in atomic reactors which the scientists can control. These reactors are used mainly for research. Under the expert guidance of Dr. Bhabha, three atomic reactors were built. They were named Apsara, Cirus and Zerlina.





This was a major step in India's scientific development. Dr. Bhabha's dreams had come true. The atomic age had finally come to India. For all his efforts, he got the full support of Jawaharlal Nehru.

Dr. Bhabha was very proud of his team of scientists at Trombay. They had successfully designed and constructed the atomic reactors. His attitude encouraged them to do even better. With him as their leader, they tried to prove to the world that they were not less intelligent than the foreign scientists.

The scientists of Trombay set up many high technology plants. Among them was the thorium plant. However, the most important achievement was the setting up of the plutonium plant. India became the fifth country in the world to have such a plant. On this happy occasion, Dr. Bhabha announced, "This is a great achievement. Indian

scientists and engineers have been able to construct the plutonium plant without any foreign help."

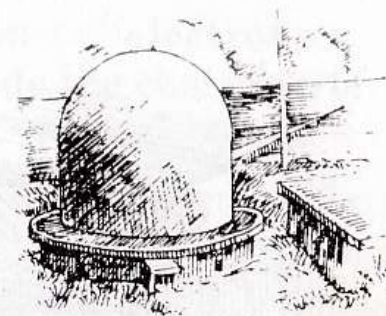
This was another golden page in the history of atomic India, and in the life of Dr. Bhabha. But he was such a humble man that he never took any credit for himself.

In August 1963, due to his planning and vision, Indian scientists started building the first atomic power station at Tarapur near Bombay. Nehru's dream of building a modern India was actually coming true. Dr. Bhabha was very happy on this occasion.

Today, we have four atomic power stations in various parts of our country, and all this was possible due to the dreams of Dr. Bhabha. India has prospered because of these atomic power stations. We should never forget the hard work put in by Dr. Bhabha. He was not only a dreamer but also took steps to make his dreams come true.



He had dedicated his life to the development of India. He remained a bachelor. Once a press reporter asked him, "Dr. Bhabha, why haven't you got married?" He replied, "Who says I am not married. I am married to creativity."



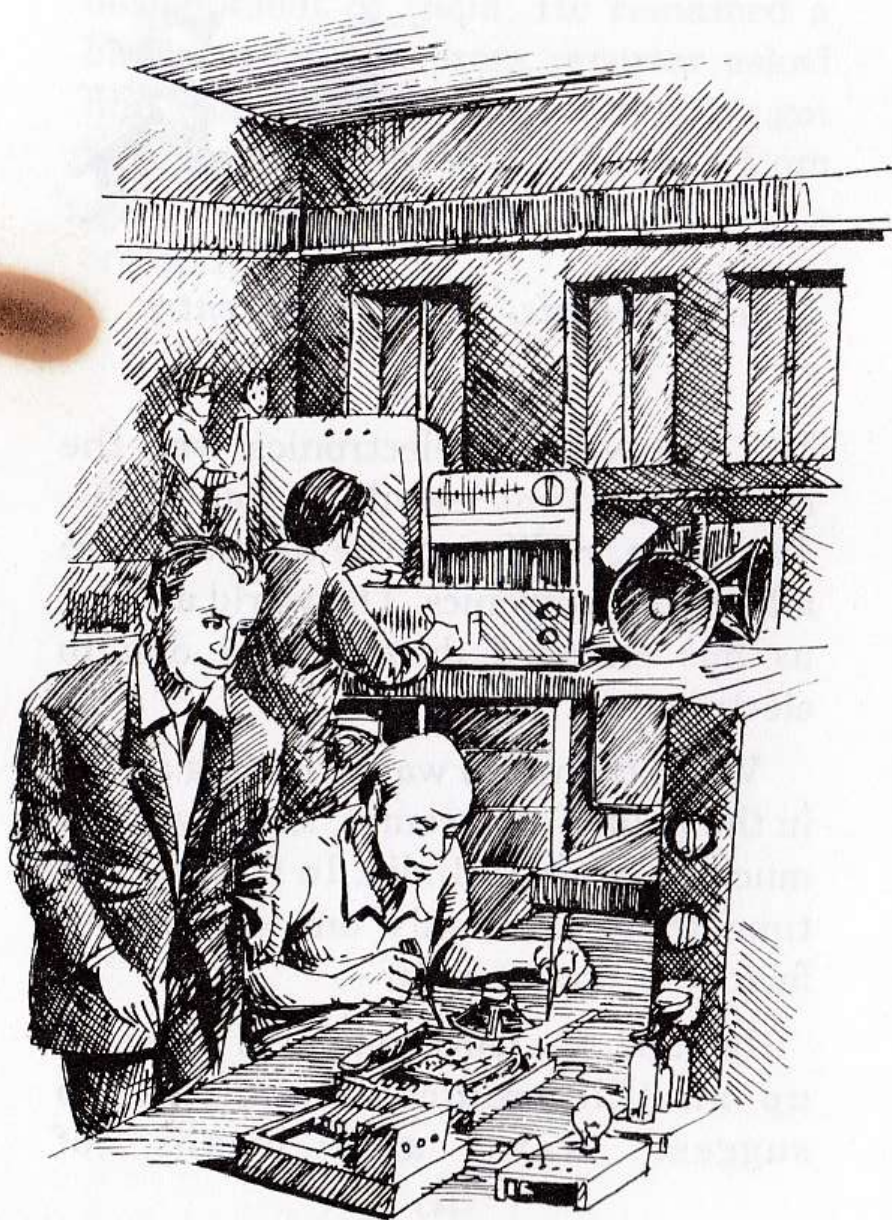
### *The Electronics Production Centre*

The discovery of electronics was the most important event of the 1960s. Television, radio and the computer are all due to electronics. The world around us has changed dramatically due to electronics.

While the world was marching ahead in the field of electronics, there was not much progress in India. In fact, at that time there was only one electronics factory in our country.

In 1962, the Government of India set up an 'Electronics Committee' to suggest ways and means of





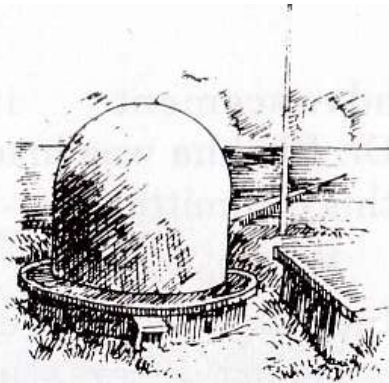
advancement in electronics. Dr. Bhabha was made the chairman of this committee.

He knew that it was important for India to advance in electronics. He gave a report after studying the whole situation. In this report, he said that electronics had a role to play not only in our daily lives but also in defence. He wanted the government to realise the importance of electronics, and make further advancements. The report that he wrote was of great help to the government.

A further step in the development of electronics was taken, when he set up the 'Electronics Production Centre.'

He always wanted India to be independent in all fields of science. He always said, "We must encourage the Indian scientists to work hard. They can match anyone in the world."





### *Man of many interests*

Dr. Bhabha was a man of refined taste. He wanted perfection in whatever work he took up. He took utmost care while building the Tata Institute and the Atomic Establishment. He loved nature. That is why he chose peaceful places amidst tall trees and green mountains to build these institutes. The paintings that are hung on the walls of these buildings are impressive. He had himself chosen the best of modern art to decorate these institutes.

Dr. Bhabha's kind-hearted and humble behaviour is remembered even

today. He would go to any length to help somebody in distress. He encouraged research in space science, radio, astronomy and microbiology. The radio telescope at Ooty is one of his creations.

Dr. Bhabha loved the mountains. He met his death on the snow-clad mountain tops of the Alps, on January 24, 1966. He was going to Geneva to attend an international conference. It was a mission of peace. The aircraft in which he was travelling crashed.

The whole world expressed sorrow at Bhabha's death. Indian scientists, especially, were heartbroken. Their leader was gone. As a tribute to him, the Atomic Energy Establishment at Trombay was named as the Bhabha Atomic Research Centre. But the best tribute we can pay him is to continue on the path that he has shown us. Science for the benefit of mankind, not for weapons or wars, should be our goal.



